

# Disturbance and Plant-Soil-Invertebrate Interactions

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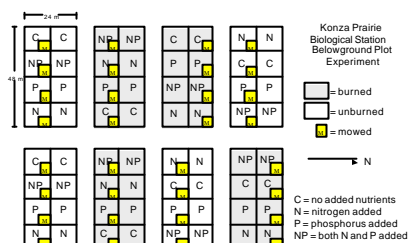


## Disturbances in Tallgrass Prairie

Tallgrass prairie ecosystems are thought to be maintained by disturbances such as fire, grazing, and drought. In the absence of fire, woody vegetation expands into grasslands, resulting in dramatic changes in plant community, soil processes, and invertebrate assemblages.

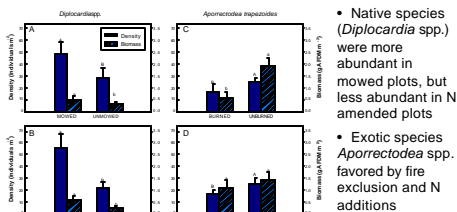


Aboveground responses to these disturbances have been extensively studied at Konza Prairie Biological Station in the Flint Hills region of Kansas. However, belowground responses are poorly understood. The Belowground Plot Experiment, established in 1986, examines the interactions between fire and mowing, and addresses questions regarding nutrient limitations and system function.



We sampled for invertebrates in each of the 64 plots in the Belowground Plot Experiment in 1994 and 1999. Two groups, the earthworms and the cicadas, exhibited strong responses to fire and mowing.

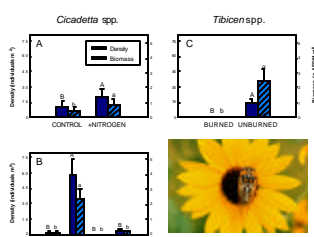
## Earthworms



- Native species (*Diplocardia* spp.) were more abundant in mowed plots, but less abundant in N amended plots
- Exotic species (*Aporectodea* spp.) favored by fire exclusion and N additions

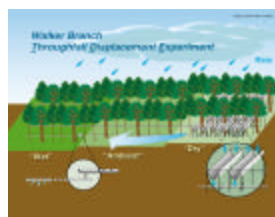
## Cicadas

- Cicadetta* spp. exhibited a positive response to fire and N addition, but was negatively impacted by mowing
- Tibicen* spp. was collected only from unburned plots
- These results suggest resource partitioning among cicadas



## Insect Herbivory in Oak-Hickory Forests

Current climate change models predict future differences in the timing and amount of precipitation falling in the southeastern US. In collaboration with Bill Hargrove, at the Oak Ridge National Laboratory, studies were initiated to assess the responses of insect herbivores to altered rainfall regimes in Oak-Hickory forests on the Cumberland Plateau. This work was conducted in plots at the Walker Branch Throughfall Displacement Experiment.



## The Litterfall Problem

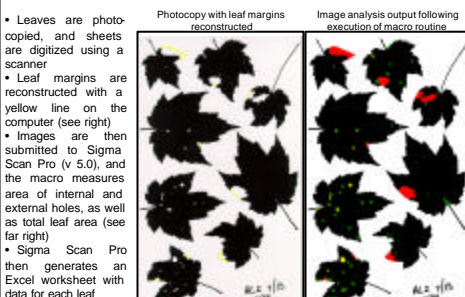
After seven years of continuous throughfall displacement, one variable that responded significantly to the treatments was total leaf litter falling at the end of the growing season. The significant trend of larger amounts of litter falling in the DRY treatment was puzzling. We hypothesized that increased insect herbivory in the WET treatment might be a partial explanation for the observed phenomenon.

Annual litter production (mean g dry mass m<sup>-2</sup> ± SE) by year and treatment. The p-values for treatment main effects were calculated by analysis of covariance, using the 1993 litter collections as the covariate. Data used by permission, courtesy of Paul J. Hanson, ORNL, ESD.

Plot	1993	1994	1995	1996	1997	1998	1999	2000
Wet	481±11	513±11	493±13	508±13	522±11	474±10a	471±11a	497±12a
Ambient	445±22	483±16	504±14	514±14	497±13	455±13a	483±11a	537±18b
Dry	558±14	511±13	523±10	546±15	533±12	534±19b	536±14b	610±17c

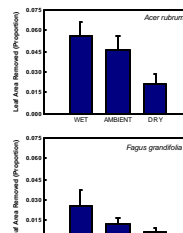
Significance:   
 na = not applicable   
 0.25, 0.10, 0.12, 0.89, .01, <.01, <.01

**The Method** We collected leaves from two species in the understorey of the plots at the TDE facility. Leaves from Red Maple and American Beech were collected from nine individuals in each treatment.



## Preliminary results

- The automated method worked very well
- For both tree species there were significantly higher herbivory levels in the wet treatment
- These data support the hypothesis that enhanced throughfall renders foliage more palatable to herbivores



## Fuel Management in Southern Pine Forests

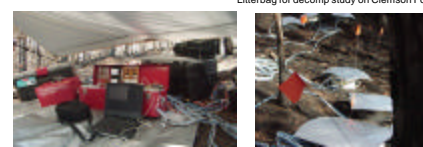
The risk of wildfire is of increasing concern to forest managers across the US as human population density in and around forested lands increases. Thus, effective fuel management practices are required to minimize the risk of damage caused by wildfires. As part of a national study of fuel management practices, plots on the Clemson Experimental Forest have been subjected to prescribed burning, thinning, and thinning plus prescribed burning (all relative to unmanipulated control plots). Studies have been initiated on these plots to address questions about the influence of these different management practices on various components of energy and nutrient cycles in this system.



## Measured Variables

In addition to the full suite of variables measured as part of the Fire and Fire Surrogate Study at the Clemson Forest, we are currently in the process of measuring the following variables to facilitate the development of working carbon and nitrogen budgets for each experimental management treatment.

- Litter Decomposition
- Wood Decomposition (above and belowground)
- Plant Production (above and belowground)
- Soil Respiration
- Litter fall



Scientists with SRS-RWU-4154, Forestry Science Laboratory, in Research Triangle Park, NC, are collaborating with us on some of the work underway at the Clemson Experimental Forest. We are employing an ACES (automated carbon efflux system) for intensive localized measurement of soil respiration responses to the experimental fuel treatments. Additionally, extensive spot measurements of soil respiration are also being collected using a portable IRGA.



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